

Introduction

During the past decade there has been an ever-increasing utilization of thermal insulation materials and systems. Furthermore, the impact of the world energy crisis has fostered additional expansion in the prediction and use of thermal insulation which will not diminish in the coming years. Applications have become more exotic, conditions of temperature and environment more extreme, and the consequent insulation systems and their means of evaluation are now more sophisticated. As a result, new methods for measurement of thermal performance must be developed and existing methods improved in order to keep abreast of this continued use of thermal insulation.

Insulating materials are generally inhomogeneous, because heat transfer in them can take place through a number of separate and interacting mechanisms. By means of more reliable measurements of heat transmission, we become more aware of these mechanisms and how the performance of certain materials and systems depend less upon solid conduction than upon other processes such as radiation, convection, and mass transfer. With more confidence in the results, we can better understand heat transmission behavior and, consequently, develop better and more economical materials and systems.

In the United States, ASTM Committee C-16 on Thermal and Cryogenic Insulating Materials is responsible for the promulgation of standards concerning thermal and cryogenic insulation materials, systems, and test methods. Within this committee, Subcommittee C16.30 on Thermal Conductance is directly responsible for test methods relating to heat transmission characteristics. The subcommittee has kept abreast of developments in the field by continuously revising and upgrading the relevant standard test methods under their jurisdiction and by communicating, where possible, with their counterparts on similar national committees. In addition, they have foreseen future requirements by developing new or extending existing standards to fulfill the potential needs. The purpose of these test methods is to uphold the realistic philosophy by evaluating an insulation under operating conditions rather than by measuring a physically-defined property which may have no meaning for these materials and systems.

Seven years ago, Committee C-16 sponsored a similar technical meeting where the topic related specifically to heat transmission measurements at cryogenic temperatures. We have arrived at a point where significant developments in the evaluation of heat transmission have taken place; therefore, the committee

decided that a further international meeting among workers in this field was justified so current technologies and ideas could be discussed and subsequently applied to future worldwide activities. The goal of this symposium was to provide a forum which would extend our horizons, cover all types of insulations at all operating temperatures, and illustrate that better measurement and performance characteristics can lead to further improvements in materials and systems.

The international group of papers in this volume covers representative subjects in the areas of fundamental studies of heat transmission processes, experimental techniques, both large and small scale, and the measurement and analysis of particular materials or systems for specific applications. The wide variety of subjects discussed, especially the Subcommittee C16.30 position paper which outlines their future philosophy, should stimulate further activities. The international representation of authors produces a further cross-fertilization of ideas which ultimately promotes greater international cooperation. One particular area concerns that of the well characterized reference materials of low thermal conductivity being made available in the future. The Appendix briefly outlines how Subcommittee C16.30 has started the work to solve the problem.

In conclusion, I wish to thank all of the authors for their efforts in making the symposium a success. The paper by O. B. Tsevetkov, "Experimental Determinations of the Thermal Conductivity of Fluids by Coaxial-Cylinder Apparatus," was received too late for inclusion in this publication and will appear in the July 1974 issue of the *Journal of Testing and Evaluation*. I trust that we have discovered new areas of concentration resulting in more numerous future meetings.

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